REMARKS

The Examiner rejected claims 35-37 under 35 U.S.C. 112 (second paragraph).

The Examiner rejected claims 1, 4, 6, 7, 31-34 and 38 under 35 U.S.C. §102(b) as being unpatentable over Noble et al. (US 6,450,116).

The Examiner rejected claims 8-15 under 35 U.S.C. 103(a) as being unpatentable over Noble et al.

Applicants respectfully traverse the §112, §102(b) and §103(a) rejections with the following arguments.

35 USC § 112

The Examiner rejected claims 35-37 under 35 U.S.C §112, second paragraph stating "claim 35 recites the limitation 'said nitrogen, inert gas and reducing gas plasma" but points out the antecedent basis of claim 35 states "generating a nitrogen and inert gas plasma' In response, Applicants have amended claim 35 to recite "said nitrogen and inert gas plasma."

Based on Applicants amendment of claim 35, Applicants respectfully maintain that claim 35 is no longer rejectable under 35 U.S.C §112, second paragraph. Since claims 36 and 37 depend from claim 35, Applicants respectfully maintain that claims 36 and 37 are likewise in no longer rejectable under 35 U.S.C §112, second paragraph.

35 USC § 102 Rejections

Applicants arguments *infra* a based in part on the structural limitations illustrated in FIG. 3A of Noble et al. and believe it would be useful to first describe those limitations.

Applicants respectfully point out that the apparatus of Noble et al. in FIG. 3A includes a gas source 313, a three-way valve 314, a gas source 315 and valves 316 and 317. Noble et al. teaches in col. 8, lines 41-43 "Coupled to gas inlet 310 is a gas source, such as reservoir or tank 313 of nitrogen-containing gas." This coupling is obviously through valves 314 and 316. Noble further teaches in col. 9. lines 30-33 "A second input of three-way valve 314 is coupled to another process gas source, such as a reservoir or tank 315 of an oxygen containing gas." Noble goes on to teach in col. 9, lines 33-45 that "In a first position, valve 314 provides for gas flow between gas source 313 and gas inlet 310 while **preventing** any gas flow from gas source 315 to process chamber 213 The valve 314 in a second position, provides for gas flow between gas source 315 and process chamber 213, while **preventing** gas flow from gas source 313 to gas inlet 310 of the applicator. Thus, in one position, valve 314 allows, for example oxygen-containing gas to be introduced into the process chamber for oxidation of the substrate or wafer, and in a second position, allows a nitrogen-containing gas to be introduced into the process chamber for nitridation of the substrate or wafer."

Applicants thus point out:

(1) Noble teaches in col. 7, lines 6 and 7 "RTP apparatus 200 includes a process chamber 213" and Examiner "second inlet port" is connected to a valve 317 which is connected to valve 314, so that gas from gas source 315 can only be supplied to the Examiners "first chamber 200.

(2) the Examiners "second chamber 300" includes inlet 310 and an outlet 375 with outlet 375 connected to gas inlet 275, so that plasma passing through the Examiners "first inlet port 275" can only be formed from gas passing through gas inlet 310 from gas source 313.

The Examiner rejected claim 1 under 35 U.S.C §102(x) stating, "forming a silicon dioxide layer on a top surface of a substrate **Col 3 line 64;** placing said substrate **100** in a first chamber **200** having a first inlet port **275** and a second inlet port **(See Figure 3A wherein the second inlet port is shown as being left of item 317 where it states "TO PROCESS CHAMBER");** generating a plasma in a second chamber **300,** said plasma comprising at least one nitridation species **Col 4 line 21,** said second chamber adjacent said first chamber **See Figure 3A,** said second chamber connected to said first chamber by said first inlet port **275** in said first chamber; transferring said nitridation species of said plasma from said second chamber to said first chamber through said first inlet port **Col 3 lines 66-67** (in regards to claim 31, this is "exhausting"); and performing a plasma nitridation in said first chamber using said nitridation species in a reducing atmosphere to convert said silicon dioxide layer into a silicon oxynitride layer **Col 4 line 9**."

Applicants contend that claim 1 is not anticipated by Noble et al. because Noble et al. does not teach each and every feature of claim 1. For example Noble et al. does not teach "performing a plasma nitridation in said first chamber using said nitridation species in a **reducing** atmosphere to convert said silicon dioxide layer into a silicon oxynitride layer" Applicants respectfully point out that since the nitridation species of Noble et al. can only be formed while gas from gas source 313 (which is never taught as containing a reducing gas) is flowing through "second chamber" 300 and no gas from gas source 315 is flowing into "first

chamber" 200, "first chamber 200" of Noble et al. only contains nitridation species and no "reducing atmosphere" as Applicants claim 1 requires. Note, the nitridation species, N* radicals of Noble et al. are not reducing species.

Further, taking into consideration that Noble et al. does teach in col. 15 line 60 to col. 16 line 51 that gas source 315 may include a hydrogen containing gas, Applicants would point out that (1), because of the operation of valve 314 the hydrogen containing gas would not be present in "first chamber" 200 at the same time as the nitridation species and that (2), the oxygen containing gas and hydrogen containing gas mixture would not be a reducing mixture but rather an oxidizing mixture as Noble et al. uses the oxygen and hydrogen containing gas mixture to form the oxide layer on the silicon substrate in what must be an oxidizing atmosphere.

Still further, taking into consideration that Noble et al. also does teach in col. 15 line 60 to col. 16 line 51 that gas source 315 may include an oxide of nitrogen gas, Applicants would point out that (1), because of the operation of valve 310 the nitrogen oxide gas would not be present in "first chamber" 200 at the same time as the nitridation species and that (2), the oxygen and nitrogen oxide gas mixture would not be a reducing mixture but rather an oxidizing mixture as Noble et al. uses the oxygen and nitrogen oxide gas mixture to form the oxide layer on the silicon substrate in what must be an oxidizing atmosphere.

Based on the preceding arguments, Applicants respectfully maintain that claim 1 is not unpatentable over Noble et al. and is in condition for allowance. Since claims 4, 7-15 and 31-43 depend from claim 1, Applicants respectfully maintain that claims 4, 7-15 and 31-43 are likewise in condition for allowance.

As per claims 32 and 35, Applicants contend Noble et al. does not teach for claim 32 "generating a nitrogen, inert gas and reducing gas plasma" or for claim 35 "generating a nitrogen and inert gas plasma" as the Examiner alleges. Applicants point out that there is no mention of inert gas in col. 16 line 60 to col. 16 line 62 as the Examiner Alleges and Applicants can not find any mention of inert gases in Noble et al. Further, Applicants point out, for the reasons presented *supra*, because of valve 314 of Noble et al. and the fact that gas source 313 includes only nitridation species, the plasma of Noble et al. cannot include an inert gas plasma component or a reducing gas plasma component.

As to new claims 39-43, Applicants point out that in col. 6, lines 2 to 7 Noble et al. teaches "The reactive portion of plasma 115 is comprised substantially of radicals. The invention contemplates that substantially all ions present in the plasma at the plasma generation (with the radicals) are eliminated prior to coming in contact with the SiO_2 layer." Applicants further point out that in col. 8, lines 54 to 62 Noble et al. teaches "Thus a plasma of ions, radicals, and electrons is generated in plasma applicator 300…Thus , the composition of the plasma that is supplied to gas inlet 275 of RTP apparatus 200 is predominantly radicals." Support for claims 39-43 may be found in paragraph [0032]] of Applicants specification, to wit "Plasma 205 is predominately a nitrogen ion, helium ion and hydrogen neutral plasma" and paragraph [0040] of Applicants specification, to wit "Plasma 205 is predominately a nitrogen ion, helium ion, hydrogen ion plasma" of Applicants specification.

As to claim 6, Applicants believe the arguments presented *supra* with respect to claims 1 and 32 are applicable to claim 6 and that claim 6 is in condition for allowance.

35 USC § 103 Rejections

As to claims 8-15, Applicants have argued *supra* in response to the Examiners § 102(b) rejection of claim 1 that claim 1 is allowable, since claims 8-15 depends from claim 1, Applicants respectfully maintain that claims 8-15 are not unpatentable over Noble et al. and are in condition for allowance.

As per claims 14 and 15, the Examiner indicates a Affidavit under 37 CFR 1.132 is required to compare the claimed subject matter with the closet prior art. Applicant traverse this requirement and offer the following arguments:

(1) Applicants have shown in FIG 8 and in paragraphs [0034] to [0038] of Applicants specification that the " introduction of a reducing species results in about a twofold increase in thickness uniformity.

(2) Applicants have shown in FIG. 9 and in paragraph [0039] of Applicants specification that "with a reducing gas present in the chamber nitrogen concentration varied by not more than 25% from center to edge in a wafer"

(3) In both the charts of FIG. 8 and 9 and paragraphs [0034] to [0039], the process without a reducing gas was similar to the process of Noble et al.

(4) Applicants contend, that charts of FIG. 8 and 9 and paragraphs [0034] to [0039], because the only difference between the invention and control was the reducing atmosphere of the invention, already constitute the closet prior art possible.

Therefore, Applicants believe claims 14 and 15 are not obvious in view of Noble et al. and are in condition for allowance.

CONCLUSION

Based on the preceding arguments, Applicants respectfully believe that all pending claims and the entire application meet the acceptance criteria for allowance and therefore request favorable action. If Examiner believes that anything further would be helpful to place the application in better condition for allowance, Applicants invite the Examiner to contact the Applicants' representative at the telephone number listed below. The Director is hereby authorized to charge and/or credit Deposit Account 09-0456.

Respectfully submitted,
FOR:
Burhnam et al.

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